E.F. Deveney / BSC Physics: Big Picture ⇒ Standard Model

Note Title 9/7/2005

BIG PICTURE!

General Relativity!

Large — SIZE — Small

Slow (Speed) FAST

≤ 1900

1) Classical or Newtonian mechanics 1687
2) Thermodynamics, Statistical Mechanics (Boltzman, Maxwell) (1900)
3) Electrodynamics
Faraday, Amphere, Gauss, Maxwell
1845 1823 1864
Maxwell E&B mix, $F^{\mu\nu}$ paper!

Special Relativity

1905 Einstein based on Maxwell's Equations
All observers must get same laws of physics
UNIFYING

Slow: Shuttle $17{,}000 \frac{mi}{hr} * \frac{5000 ft}{1 mi} * \frac{1 m}{3ft} \frac{1 hr}{3600 s}$

$\simeq \frac{(10)(5 \times 10^3)}{12} \sim 5000\ m/s$

$\frac{v}{c} = \frac{5 \times 10^3}{3 \times 10^8} \sim 10^{-5}$ = slow!

Fast cosmic μ's = .95c

Space-time $x^\mu = (ct, x, y, z)$ mix
GR = 1916

Quantum Mechanics (Q.M.)

1905 - 1926, Now!

Baseball ~ 10^{23} particles

1 ← 10 cm

-e

nuc 10^{-15} m 10^{-10} m

Visible Light 2 eV
H-atom Spectra to .000001 eV

$i\hbar \frac{\partial \Psi(x,t)}{\partial t} = H \Psi(x,t)$

antiparticles, tunneling

Schrodinger, Dirac, Bohr
1926 1928
Plank, Born – Schro prob interpret
1934

Quantum Field Theory (QFT)

$F^{\mu\nu}$ = Electromagnetic field

Ψ = particle field

+

Relativity (special)

= QFT

Feynman
Schwinger
Tomonaga (Sin-itiro)

1963

Most successful Theory ever!

adds γ e e

Lamb shift H-atom .000001 eV

SM =

e	u	lepton
ν_e	d	+
μ	s	quark
ν_μ	c	+
τ	t	Boson
ν_τ	b	γ

W^-, W^+, Z^0, (Higgs?), g